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Loren D. Coen
Sanibel-Captiva Conservation Foundation Marine Laboratory

Eric C. Milbrandt
Sanibel-Captiva Conservation Foundation Marine Laboratory

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The Refuge and Foundation's Linked History

In many ways Sanibel and Captiva Islands are unique because so much of them has been preserved as wildlife habitat. The ''islands'' are actually a group of barrier islands off the southwest coast of Florida, with over 60% of the land protected from development remaining in conservation forever (''land'' includes mangrove wetlands, interior freshwater wetlands, and tropical hardwood hammocks). The impetus for the creation of the Sanibel–Captiva Conservation Foundation Marine Lab stemmed from island inhabitants' unique appreciation of the rich diversity of the islands' wildlife; hence our initial focus here is on the Foundation and the National Wildlife Refuge and their shared ethic that ultimately lead to the Marine Lab's inception only 9 yr ago.

The Sanibel Captiva Conservation Foundation (hereafter SCCF) has forged a solid regional environmental reputation in southwest Florida over the past 43 yr (since 1967), as evidenced by the reliance of local governments, federal and state agencies, and local universities on SCCF for leadership, problem solving and, more recently, scientific expertise. The Foundation owns and manages nearly 2,000 acres of land on the barrier islands that together offer convenient access to coastal, estuarine, and marine ecosystems that transition between tropical and subtropical zones (see Figure 1). SCCF has been the unrivaled leader in southwest Florida by: (1) preserving habitat through land acquisition; (2) removing exotic species; and (3) addressing problems related to freshwater releases by the U.S. Army Corps of Engineers (USACOE) and the South Florida Water Management District (SFWMD).

History of the Foundation: The J. N. ''Ding'' Darling Refuge and the SCCF

The Sanibel–Captiva Conservation Foundation (http://www.sccf.org/) was founded after the formal dedication of the J. N. ''Ding'' Darling National Wildlife Refuge in 1967. After the death of Jay Norwood ''Ding'' Darling in 1962, local and national groups worked with the U.S. Fish and Wildlife Service (FWS) and the state of Florida to merge several tracts of land into one single federal refuge. Five years later, once this plan was realized, the members of the locally based, J. N. ''Ding'' Darling memorial committee transitioned into SCCF.

SCCF was founded in 1967; ever since its inception, it has played a major role in creating island policy on matters of development and alteration of the shoreline. Local Audubon leader Roy Bazire posed the question, ''Real estate developments are bound to take place … Can some sort of standards be set up to permit the inevitable to take place, but at the same time hold ecological damage to a minimum?''

The first islandwide conservation conference, held in 1968, laid out a course of action for SCCF—advocacy, marine research, education, land acquisition, and preservation of the unique habitats found on and around the barrier islands of Lee County, FL. It was during that first conservation conference that Florida Atlantic University (FAU) first expressed interest in establishing some sort of a marine center for both teaching and research in a protected subtropical area like Sanibel. Ultimately, the challenge was to take such a multidimensional agenda, then set priorities, and find the means to accomplish this goal.

Grassroots efforts backed by good science and perseverance have shaped the islands and will guide their future. The work done for the past several decades by the SCCF, the J. N. ''Ding'' Darling National Wildlife Refuge Complex, the Sanibel Audubon Society, local residents, and the city of Sanibel has resulted in an unparalleled array of conserved lands that stretches from Cayo Costa Island to Sanibel. Because the preservation of Sanibel's unique freshwater interior was SCCF's initial priority, one of the first steps taken was the purchase of unique freshwater wetlands along the Sanibel River corridor. Since its incorporation as a 501c3 nonprofit in October of 1967, the Foundation has acquired 500 more parcels.

One of the early supporters of SCCF was The Nature Conservancy (TNC), then under the leadership of Dr. George Cooley. Dr. Cooley was a retired investment banker who began work

in conservation and botany as a research fellow at Harvard's Gray Herbarium. In 1955, Cooley published ''The vegetation of Sanibel Island, Lee County, Florida,'' a description of Sanibel Island's rich botanical diversity prior to the spread of exotic vegetation. Dr. Cooley later established an herbarium at SCCF and coordinated a complete plant collection of native and naturalized species found in Lee County.

Relevant documented marine research in and around Sanibel dates back to the early 1900s. For example, during the atypically cold winter of 2009–2010 significant mortality rates of snook, manatees, Goliath grouper, and turtles were seen (pers. obs.). A similar phenomenon had been recorded in 1936 by researchers. Margaret Storey from Stanford University and E. W. Gudger from the American Museum of Natural History published an article in the journal *Ecology* entitled Mortality of fishes due to cold at Sanibel Island, 1886–1936 and a followup note in 1937. The articles documented nine cold-water fish kills on Sanibel from 1886 to 1936 and listed 48 fish species killed during those events. Also in 1936, Louise Perry published an article on pen shell habitat offshore of Sanibel, emphasizing the associated species within the *Atrina*-dominated bottoms (Perry, 1936).

In 1969, Charles LeBuff published the foundation's first research monograph, ''Marine turtles of Sanibel and Captiva Islands, Florida.'' LeBuff was a research technician at the J. N. Darling NWR and looked to SCCF for additional support for several projects: the construction of tanks for young turtles, the production of a film on loggerhead life history, and the monitoring of nests and tagging of sea turtles on Sanibel. (The latter effort has been ongoing; the monitored area now extends along the west coast of Florida, from the SCCF to south of Marco Island.)

Following the 1974 incorporation of the city of Sanibel, the city needed to develop a land-use plan. In 1975, John Clark, a former Woods Hole marine scientist, conducted a 2–3-mo assessment of the area's natural and cultural resources. The study was sponsored by SCCF and was intended ''to enlighten those involved in the development and control of development on barrier islands elsewhere in the nation.'' The report contains information on every facet of the island's natural systems, including the beaches, mangroves, interior wetlands, hydrology, and wildlife. The Sanibel Report (see http://www.sccf.org/content/122/SCCF-and-The-Sanibel-Report.aspx) was published and distributed nationally and contained the recommendation that less density would provide a higher quality of life for residents and wildlife and increase the value of homes, land, and vacation rentals. The book was later used by universities for community planning, and it made Sanibel Island the first city to base its land-development code on the preservation of natural resources.

For the waters surrounding Sanibel and Captiva Islands, the Sanibel-Captiva Conservation Foundation (prior to the establishment of the dedicated Marine Lab) promoted awareness about the seagrass destruction that had resulted from marina expansion and the filling of 1,000 acres of mangrove on Pine Island and Punta Rassa. To respond to the destruction, Dick Workman, the first executive director of SCCF (1973–1979), worked with the Foundation's board of directors to review line-by-line draft management plans for Florida's Aquatic Preserve Act, which led to the creation of both the Estero Bay and Pine Island Sound Aquatic Preserves (PISAP, http://www.dep.state.fl.us/coastal/sites/pineisland/). Together, these preserves encompass over 100 sq mi of seagrasses, oyster reefs, tidal flats, and mangroves. They are also home to representatives of 40% of Florida's threatened and endangered species. (Among the other ''dignitaries'' that have directed SCCF is Porter Goss, former two-term mayor of Sanibel; Lee County Commissioner; CIA operative for its Directorate of Operations [the clandestine section of the CIA]; former Director of Central Intelligence [how many other Gulf of Mexico facilities can state that?]; and a member of the U.S. House of Representatives from Florida.)

The Foundation's Nature Center was dedicated in December 1977. In 1978, a native plant nursery was established to make indigenous plants more available and provide a focus for learning. Soon after, SCCF began offering educational programs and added educational staff. During this time, SCCF funded a 2-yr research initiative led by Dr. Susan Cook, then research director at the Bermuda Biological Research Station (BBSR), to collect baseline data on mollusk populations in Tarpon Bay and Pine Island Sound.

The 1980s were an active time at the Foundation: SCCF's intern program was formalized and permanent intern housing was added (now used by marine lab interns and staff); a grant from The Bruning Foundation helped SCCF refocus on habitat management by allowing it to bring a full-time restoration ecologist on board. When 27 acres along the Sanibel slough became available in 2006—the last significant property that would ever be available on the Sanibel River—islanders stepped up to purchase the land and make our founding dream a reality. But there is always more to do and more to preserve, so land acquisition remains one of the core missions of SCCF.

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In 1992, SCCF took over the monitoring and sea turtle conservation program. Charles LeBuff, who, as previously mentioned, had been running the program, later partnered with George Weymouth to study the area's alligators and their relationship to human population growth; his work included relocation studies and an educational campaign about the dangers of feeding alligators. These efforts led to the recognition that alligators are a necessary part of Sanibel Island's ecology, in large part because they ''patrol'' rookeries, which deters raccoons and snakes from raiding nesting bird colonies. LeBuff and Weymouth's efforts are a good example of the many SCCF-coordinated scientific studies that have kept people informed about the ecology of Sanibel and Captiva Islands.

A SCCF Marine Laboratory at Tarpon Bay

In contrast to the extensive histories of many of the well-known and prominent Gulf of Mexico marine labs described in the present volume, the Sanibel–Captiva Conservation Foundation's Marine Lab has a very brief history, as it was only formalized in 2002. To date, the Marine Laboratory has had only two directors. From 2002 to 2006, the laboratory was led by Dr. Stephen Bortone, who formerly served as the Director of the Minnesota Sea Grant College, the Director of Environmental Science at the Conservancy of Southwest Florida, and the Director of the Institute for Coastal and Estuarine Research at the University of West Florida. Currently, Dr. Bortone serves as the Executive Director, Gulf of Mexico Fishery Management Council in St. Petersburg, Florida. From 2007 to 2011, the lead author of this article (Dr. Loren D. Coen) was the Marine Lab's director.

Understanding the relationships between freshwater, estuarine, and marine systems within the Caloosahatchee watershed has been the focus of the Marine Lab. The Caloosahatchee is a highly modified system, the management of which includes working through the competing needs for freshwater in upstream agricultural areas versus the demand for water supply to the urbanized areas of the southeast coast of Florida. The entire freshwater watershed is artificially connected from Orlando to the Florida Keys, and from Palm Beach to Sanibel. There is a great need to understand human impacts on biological functions, especially given the planned ''replumbing'' of the Everglades, the world's largest restoration effort. The Comprehensive Everglades Restoration Plan (CERP) and the more recent River of Grass plan, which involves acquiring land owned by the U.S. Sugar Corporation, will greatly affect the delivery of surface waters throughout the southern portion of the state and is expected to result in complex biological responses. These results will be of scientific importance, as relatively little is known about the biological diversity in this subtropical region of zoogeographic transition (considered the southern range limit for many temperate species and the northern limit for tropical species).

As previously mentioned, as early as 1968 a representative from FAU expressed an interest in establishing a marine center for research and teaching in a protected subtropical area like Sanibel. In 1987, when the Refuge reconfigured its plans for the then Tarpon Bay Marina, Executive Director Erick Lindblad (1987 to present) approached Ron Hight, who was the ''Ding'' Refuge Manager, about leasing the marina's old shell shop (Figures 2–4). Lindblad had recently come to Sanibel after serving as the Director of the Newfound Harbor Marine Institute on Big Pine Key (http://www.nhmi.org/, or ''Seacamp''). The old shop structure was upgraded by SCCF, and over 900 hr of volunteer time was invested to establish the Southwest Florida Barrier Island Research Laboratory to conduct water quality monitoring and analysis. Water quality has always been a core mission of SCCF. In 1999, two SCCF technicians, Jim Locascio and Paul Rudershausen, were hired to conduct faunal surveys of local seagrass habitat. The monitoring program sampled 28 stations monthly and provided baseline data on a number of chemical and biological parameters on Sanibel and in San Carlos Bay (this program later became part of the University of Florida's Lakewatch and Baywatch programs). An FWS cost-share grant helped support the construction of a weather and water quality station in Tarpon Bay that provided real-time data linked to the Internet. Other work conducted by Jim and Paul at the Tarpon Bay lab resulted in papers on mercury levels in spotted seatrout and gaff-topsail catfish, dietary habits of gaff-topsail catfish, faunal surveys of seagrass habitats, and leaf litter decomposition rates.

SCCF went on to formalize a marine laboratory by assembling a Science and Research Advisory Council to determine and develop scientific goals for the eventual establishment of a lab. The council consisted of Drs. Ernie Estevez, Director of Research at Mote Marine Laboratory; Dave Tomasko, then Senior Scientist at SFWMD (now at PBS&J); Greg Tolley, Director of the Coastal Watershed Institute and Professor at Florida Gulf Coast University (FGCU); and Steve Bortone, then Director of Environmental Servic-

es at the Conservancy of Southwest Florida (later the lab's first director).

Gretchen Carhartt Valade (chairman of Carhartt, Inc. and CEO of Mack Avenue Records) made a significant contribution that allowed us to structure a 5-yr budget projecting operation of the lab to begin in 2002. Once all the fundraising goals were met and Dr. Bortone was hired as the lab's first director, he immediately began to organize the Marine Laboratory by hiring staff and improving the facilities at Tarpon Bay. The lab's work was highlighted in a conference on ''Estuarine Indicators'' in 2005, the proceedings of which were published by CRC Press. Dr. Bortone recognized that in order to put SCCF's Marine Laboratory on the map, the staff would need to present their research at scientific meetings, obtain extramural grants, and publish their findings in peer-reviewed journals. Soon after Bortone took the helm, the lab became a member of the Southeast Association of Marine Laboratories (SAML-NAML) and the Organization of Biological Field Stations (OBFS). The old shell shop owned by the Refuge at Tarpon Bay was once again refurbished, painted, and furnished with several private offices, a shared office, and a small lab space. A small 23-ft Carolina Skiff was donated to the lab by Tom and Sue Pick, who continue to visit the lab and cruise on Tarpon Bay. A truck was also bought for launching the boat and to allow staff to attend out-of-town meetings.

Three new staff members were hired to develop a research and monitoring program for the waters surrounding Sanibel and Captiva Islands. In 2003, the lab's first research assistant arrived, Emily Lindland. She obtained a B.S. in biology from the area's new state university, Florida Gulf Coast University (FGCU). A second research assistant, Jaime Greenawalt (now Greenawalt–Boswell) who had recently finished her M.S. at the University of Florida (her research was on scallops) was hired also. Dr. Eric Milbrandt (now the lab's third director) arrived in early 2003 from the University of Oregon, adding a second on-site PhD-level staff member. Immediately, the staff compiled an annotated bibliography of relevant research in southwest Florida and developed a research and monitoring plan to provide the beginnings of a Status and Trends assessment of important habitats surrounding the islands. Not surprisingly, with few institutions in the area except Mote, there was a paucity of information about the estuary and its functioning. Even though many staff at Florida Fish and Wildlife Conservation Commission's (FWC) Fish and Wildlife Research Institute (FWRI) had worked extensively offshore of Sanibel and Captiva (including some of the Hourglass Cruise Reports, the results of a major systematic biological sampling program undertaken on the continental shelf of the Gulf of Mexico conducted by the Marine Research Laboratory of the Florida Board of Conservation from 1965 to 1967), much more research was needed. Therefore, SCCF developed a 5-yr plan to collect baseline data on mangroves and seagrass beds, with a focus on microbial diversity, fish habitat utilization, and scallops.

The lab is currently adjacent to the Pine Island Sound Aquatic Preserve within the J. N. ''Ding'' Darling NWR (Figures 2–4), one of the few marine ''wilderness areas'' in the United States. We have access to numerous subtidal, intertidal, and marginal habitats (e.g., patch reefs and seagrass, mangrove, and salt-marsh habitats) that contain very diverse plant and animal communities. Year-round access to freshwater wetlands, the Caloosahatchee River and Estuary, San Carlos Bay, Pine Island Sound, and the Gulf of Mexico provides an unparalleled natural laboratory for examining the influence of variable freshwater inflow and anthropogenic impacts on estuarine and coastal ecosystems. In addition, bioassays can be conducted easily in the estuary at our dock or in our constant-temperature building.

Most of the area's habitats are important nursery areas, making them complex, three-dimensional structures for resident species. Mangroves fringe the undeveloped shorelines and lower tidal tributaries, with four species present (*Rhizophora mangle*, *Avicennia germinans*, *Laguncularia racemosa*, and *Conocarpus erectus*). Seagrasses are represented by turtle grass, (*Thalassia testudinum*), manatee grass (*Syringodium filiforme*), shoal grass (*Halodule wrightii*), *Halophila* spp., and widgeon grass (*Ruppia maritima*), along with a diverse assemblage of macroalgae. Eastern oyster (*Crassostrea virginica*) intertidal reefs occur immediately downstream of tidal tributaries. In addition to serving as nursery habitat for juvenile fishes, these reefs are home to dozens of resident fishes and decapod crustaceans that serve as forage for important fisheries species. In addition to these vegetated habitats, largely uncharacterized patch reefs, mudflats and sand bottoms are present.

Numerous endangered and threatened species live on and around Sanibel, including the largest concentration of West Indian manatees (*Trichechus manatus*) in the United States. The islands are nesting grounds for the loggerhead (*Caretta caretta*) and other sea turtle species, including green (*Lepidochelys olivacea*) and Kemp's Ridley (*Lepidochelys kempii*) turtles. The

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Caloosahatchee and Charlotte Harbor estuaries were recently designated by National Marine Fisheries Service as critical habitat for the already listed (as endangered) smalltooth sawfish (*Pristis pectinata*). Piping (*Charadrius melodus*) and snowy plovers (*Charadrius alexandrinus*) are other threatened species that overwinter on Sanibel and adjacent islands.

Partly because of the large nutrient loading rate to the estuary and high rainfall, harmful algal bloom species such as *Karenia brevis* and *Lyngbya majuscula* and massive outbreaks of red drift algae (e.g., *Hypnea spinella* and *Gracilaria tikvahiae*) have recently been major concerns; in fact, the SCCF lab just completed a collaborative 2-yr study with researchers from FGCU, SCCF, NOVA Southeastern University, University of New Hampshire, Dauphin Island Sea Lab (DISL), Woods Hole Oceanographic Institution (WHOI), and University of Miami.

As the Marine Laboratory staff worked on a plan to provide a trend analysis of the quality of local habitats, grant-funded research was integral to the development of the Marine Laboratory's identity. In partnership with ''Ding'' NWR, a monthly trawl study of Tarpon Bay was conducted. Additionally, a multiyear grant from the SFWMD provided funds to monitor seagrasses in the Caloosahatchee Estuary and lower Pine Island Sound. One of the lab's early research areas focused on spotted seatrout (*Cynoscion nebulosus*) growth rates and their relationship to habitat and water quality. The effort was partly funded by SCCF and supplemented by the Charlotte Harbor National Estuary Program (CHNEP) and the University of South Alabama, through a collaboration with Dr. Bob Shipp (University of South Alabama and DISL).

Under the direction of Dr. Bortone and Bob Wasno, the Florida Sea Grant Extension Agent for Lee County (now at FGCU's Vester Lab), an aquaculture facility was built behind the Marine Laboratory. The grow-out and lab/feeding room facilities—called ''REDStart''—were built in 2002 (see Figures 5–8) and run by retired volunteers. The project was funded by numerous private and public sources. The purpose was to demonstrate that community-based red drum fishery enhancement programs are possible. Juvenile red drum (*Sciaenops ocellatus*) habitat preferences and the fate of hatchery-raised fry were the focus of a grant-funded project in partnership with the SFWMD. In order to conduct the day-to-day management of the project and the weekly fieldwork, two additional research assistants were hired.

Other grant-funded research included a study on the status of the local blue crab (*Callinectes sapidus*) populations. Research on the bay scallop (*Argopecten irradians*) continued through a collaboration with Drs. Jay Leverone (then at Mote Marine Laboratory, now at the Sarasota National Estuary Program) and Steve Geiger from FWRI and Bill Arnold (then also at FWRI, now at NOAA). Numerous scallop juvenile (recruitment) monitoring stations were established with partial funding from CHNEP through Mote and the NWR; however, few juvenile scallops were collected. In 2005, an effort to restore bay scallops throughout Pine Island Sound was attempted by releasing hatchery-raised scallop spat into large enclosures. The results were overwhelmingly successful, as described by Leverone et al. (2010). Today, we continue monitoring and restoring bay scallops with volunteer farmers and have applied for funding to expand these efforts. Staff also pursued collaborative research with the Florida Department of Environmental Protection's (FDEP) Charlotte Harbor Aquatic Preserve (CHAP).

The Atlantic hurricane season of 2004 was unforgettable, with five named storms making landfall in Florida. Hurricane Charley struck the northern tip of Captiva Island at peak intensity of 150 mph sustained winds and caused major damage to property and to the mangrove wetlands. Sanibel Island was evacuated and closed to everyone except emergency workers. Luckily, Refuge Manager Robert Jess was allowed on the island the day after the storm and was able to start the lab's generator to power the freezers, thus saving expensive reagents and critical samples. Because he was not provided a key to the building, the back door to the lab was forced open (doorframe and door smashed) and had to be replaced in the aftermath. But that was a small price to pay for freezers that were still cold when we returned.

Entry back to the island was allowed after a week. There was much work to be done to clear fallen vegetation. Fortunately, there had been almost no storm surge, so we had no flood damage, despite the fact that the lab is only a few feet above sea level. In the following months, the same hurricane evacuation was repeated at almost 2-wk intervals when hurricanes Francis, Ivan, and Jeanne made landfall. The contents of the lab were moved to the higher ground of the Foundation's main building conference room, including all electronics, equipment, the library, and important paperwork. The boats were transported off-island and secured, and hurricane panels were hung on the windows. Each time the plan was executed it would take a week, then moving back would take a week, and then it

started all over again. Overall, it was tremendously frustrating and very unproductive. We repeated the exercise in 2005—when a record number of named hurricanes and tropical storms impacted Florida.

One bright spot during this time was ongoing research on mangrove wetlands initiated in 2003, prior to the landfall of hurricane Charley. Stem mapping and seedling densities were collected prior to the storm and revisited in the months after Charley. As part of a special issue of *Estuaries and Coasts* on the 2004 hurricane season in Florida, we published an article describing the damage and suggested that it would be a slow recovery in areas with hydrological restrictions caused by human activities. Other research, done in collaboration with Drs. Ed Proffitt (FAU), and Steven Travis (USGS Wetland Science Center, Lafayette, LA), demonstrated a significant decrease in reproduction by fringing red mangroves. Other mangrove research being conducted was funded by a grant from the SFWMD to test several on-the-ground restoration techniques. Generally, a mangrove die-off is caused by hydrological impairment or subsidence, rendering techniques such as planting seedlings ineffective. The die-off area we studied was colonized by *Batis maritima* and used extensively by wading birds. Several techniques were assessed, and staff found that *B. maritima* promoted black mangrove seedling survival.

Dr. Richard Bartleson joined the lab in 2006 from the SFWMD (PhD from Horn Point, UMCES) and immediately used his expertise in seagrass physiological ecology to conduct microcosm experiments with *Vallisneria americana*. In order to conduct temperature-controlled experiments, a new microcosm facility was built alongside the aquaculture tanks behind the lab. A prefabricated shed was purchased, and outfitted by staff to house the necessary tanks, pumps, chillers, lights, and temperature-controlled water and air. The facility was used for over 2 yr to measure the responses of *V. americana* to temperature, light, and salinity; the shed is still being used by lab staff. Dr. Bartleson also maintains a record of red tide counts around Sanibel, and he received grant funding to study nuisance macroalgae around Sanibel Island in 2006. More recently, he set up grazer exclosures in the Caloosahatchee and restored *Ruppia maritima* that had been propagated in the aquaculture tanks at the laboratory. Rick has contributed directly to SCCF and the lab with donations of lab equipment (often purchased on eBay).

In 2007, after a national search, the lab director's position was filled by Dr. Loren Coen (2007–2011). Prior to coming to Sanibel (from 1993–2007), he had directed the Shellfish Research Section as a Senior Marine Scientist at SCDNR's Marine Resources Research Institute (MRRI) in Charleston, SC. Dr. Coen brought his expertise in marine invertebrates and oyster restoration and immediately prioritized the administrative and facility needs for the laboratory. Since his arrival, Dr. Coen had been working on enhancing collaborations from outside of the immediate area, expanding the extramural (now for the first time federal grants were included (Figure 9)) funding base, staffing, and establishing an even better relationship with the new Refuge manager, Paul Tritaik. Restoration research has expanded with projects in Clam Bayou on seagrasses, mangroves, oysters, and water quality, and funding sources have greatly diversified. Several new hires expanded the expertise and equipment at the lab (see below) and ties to FGCU were expanded. In 2007–2008 a new concession building on Tarpon Bay (for Tarpon Bay Explorers) was erected, paid for by FWS, and the old one torn down. In 2010 the Laboratory's main building was the recipient of a new roof paid for by the Refuge.

Another collaborator on the island has been The Bailey–Matthews Shell Museum (www.shellmuseum.org). It was incorporated as a nonprofit museum in 1986. In February 1996, Dr. José Leal was hired as its director, and in 1997 the museum became the publisher of *The Nautilus,* the second-oldest English-language shell science journal in the world, with Dr. Leal as editor-in-chief. The museum is entering its 13th year of offering a formal field trip program for Lee County public school fourth-graders, and it now sponsors most of these trips through the Adopt-a-Class program. In addition to over 35 exhibits, public programs, and museum resources, the museum has embarked on collaborations with national and international educational and research institutions, and it offers facilities in its collection and research area for visiting researchers, interns, and students. The museum is 1 of only 48 museums in Florida accredited by the American Association of Museums (AAM).

Along with the establishment and growth of the Marine Laboratory has been the very rapid growth of Florida Gulf Coast University (FGCU). In 1991 the former Florida Board of Regents formally recommended FGCU's creation as the 10th state university in southwest Florida; in 1992, a site was donated near Interstate 75. Soon after, in 1993, a president was named and initial staff and faculty were hired. Construction broke ground in late 1995, and the first class was admitted in early 1997. FGCU recently celebrat-

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ed its 10th anniversary. More than 10,000 students have matriculated, many from graduate degree programs. In November 2000, SCCF and FGCU formalized interactions between the Foundation and FGCU by signing a Memorandum of Understanding (MOU) to enhance joint planning, environmental education, shared facilities, and collaborative projects. Because both entities have grown and matured significantly since then, the university and SCCF are currently working on a new, updated MOU.

All of the Lab's senior (PhD) staff have formal appointments at a nearby state university; they facilitate visits to the field by undergraduates, give lectures, and serve as coadvisors for graduate students. We recently started a more formal year-round internship program at the lab, sponsored by the generous supporters of the Foundation and grants. The lab interns now do an independent study project, along with a paper/presentation to staff. Several of the lab's interns have gone on to graduate school since 2006 (e.g., SUNY Stony Brook, Savannah State University).

The Marine Lab's expertise today focuses on nutrient cycling; water quality modeling; habitat restoration; seagrass, shellfish, and mangrove ecology; and Geographic Information Systems (or GIS). The lab has continued to expand its list of collaborators with scientists from the University of South Florida, Florida Atlantic University, University of Miami, NOVA Southeastern University, University of New Hampshire, University of South Alabama, Rutgers University, Dickinson College, Virginia Institute of Marine Science, DISL, FWRI, Monterey Bay Aquarium Research Institute (MBARI), Mote Marine Lab, the CHNEP, and TNC, among others.

For a small and relatively ''young'' entity, the lab is reasonably well-equipped for such a young and small field station with regard to boats, vehicles, and dedicated equipment (see http://www.sccf.org/content/91/Facilities-&-Resources.aspx). We also have a small workshop that houses the lab's dive locker (with aluminum tanks) and most field sampling gear. In 2010, the lab purchased a new Olympus research-grade BX-51 compound scope with epifluorescence and interference contrast, along with a digital camera system from two local island lab donors.

River, Estuary, and Coastal Observing Network (RECON)

A major effort and a significant core program for the Marine Lab is its River, Estuary, and Coastal Observing Network (RECON) launched in the fall of 2007. This uniquely funded (by a variety of private and public sources, including the Lee County Tourist Development Council, the city of Sanibel, West Coast Inland Navigation District (WCIND), and AT&T; see http://recon.sccf.org), multinode observing system provides state-of-the-art, real-time reporting on key water quality parameters. Private donors paid for most of the hardware for RECON (over $650K), probably a unique occurrence in today's world. Data are transmitted hourly and are available at http://recon.sccf.org. Data come from an array of seven autonomous sensor arrays spanning over 160 km of the Caloosahatchee watershed, which ranges from freshwater to full seawater (Figure 10). The data are used to improve freshwater management and to protect estuarine-dependent organisms and habitats.

The lab has nine Satlantic Land/Ocean Biogeochemical Observatories (LOBOs), which are automatic data collection and delivery systems; seven of these are always deployed, making up the Foundation's ''RECON'' network. Each of the nine LOBOs has a Satlantic ISUS (in situ ultraviolet spectrophotometer), a Satlantic Stor-X data logger, a WETlabs Water Quality Monitor (WQM) that monitors conductivity, temperature, depth, DO, chlorophyll and turbidity, and a WETlabs colored dissolved organic matter (CDOM) ECO. We also have on one of the stations a Nortek Aquadopp 2-d current profiler. RECON measures water properties every hour with the use of optical sensors for numerous parameters, including chlorophyll *a*, turbidity, CDOM, nitrate, dissolved oxygen, salinity, temperature, and water depth (tidal information). All stations autonomously store data, transmit to shore through cellular modems, and are made Web accessible in real time with the use of LOBOViz™ software at an offsite server.

This system is useful for a variety of scientific research projects and management decision processes, such as determining freshwater releases or nutrient loading standards (total maximum daily loads [TMDLs]). For example, we are studying changes in hydrodynamics, water quality, and biological diversity around Blind Pass, a recently dredged tidal pass. Blind Pass had been closed for over 10 yr and was recently reopened to the Gulf of Mexico. A mobile RECON unit is deployed at multiple nearshore locations to link the collected data to the stationary RECON units at Blind Pass and the adjacent Redfish Pass. These data are synergistically supplemented with those from another grant-supported project and used to determine the status and trends in bacterial indicators and nutrient pollution. By establishing this association between the station-

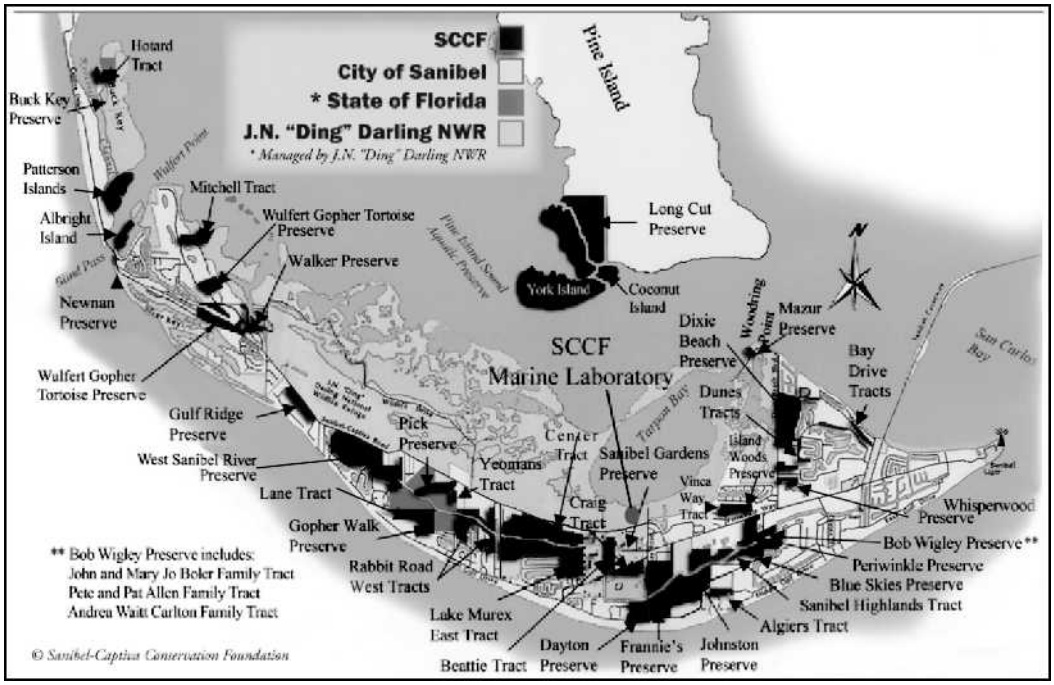

Fig. 1. Conservation lands on Sanibel and Captiva Islands, FL. SCCF owns and manages over 1,800 acres of land on or near Sanibel–Captiva, Florida. The current laboratory sits on Tarpon Bay, on J. N. ''Ding'' Darling NWR property, a refuge that is one of the busiest in their system.

Fig. 2. Aerial view of Tarpon Bay, lab shown in middle lower part of image end of arrow (2008).

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Fig. 3. Aerial view of new (grey roof) and old (red roof) concession buildings for Refuge, the arrangement of dock, boat area, and current SCCF Lab (yellow circle, 2009).

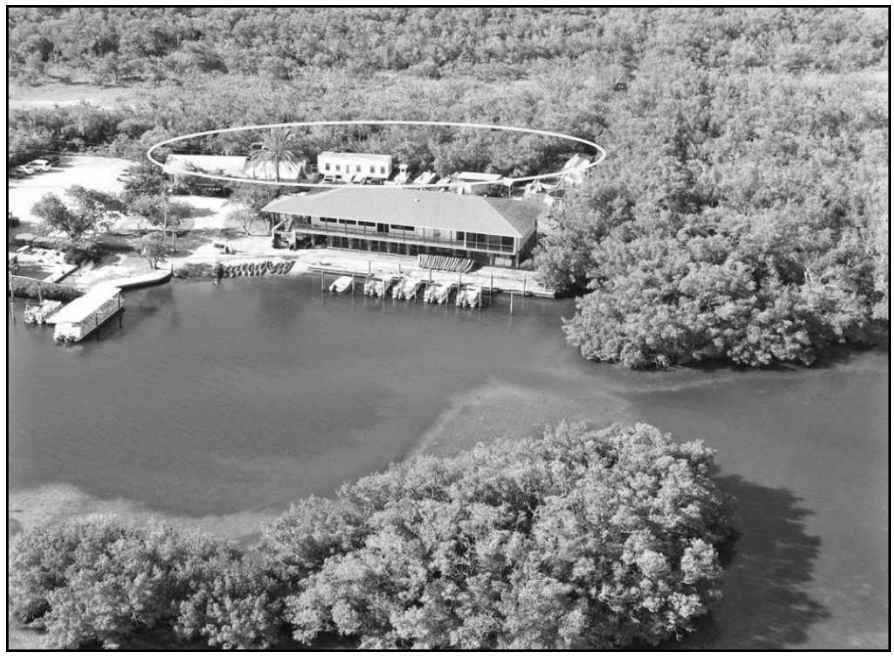

Fig. 4. Aerial view of new concession building for Refuge, the arrangement of dock, boat area, and current SCCF Lab (the yellow oval outline).

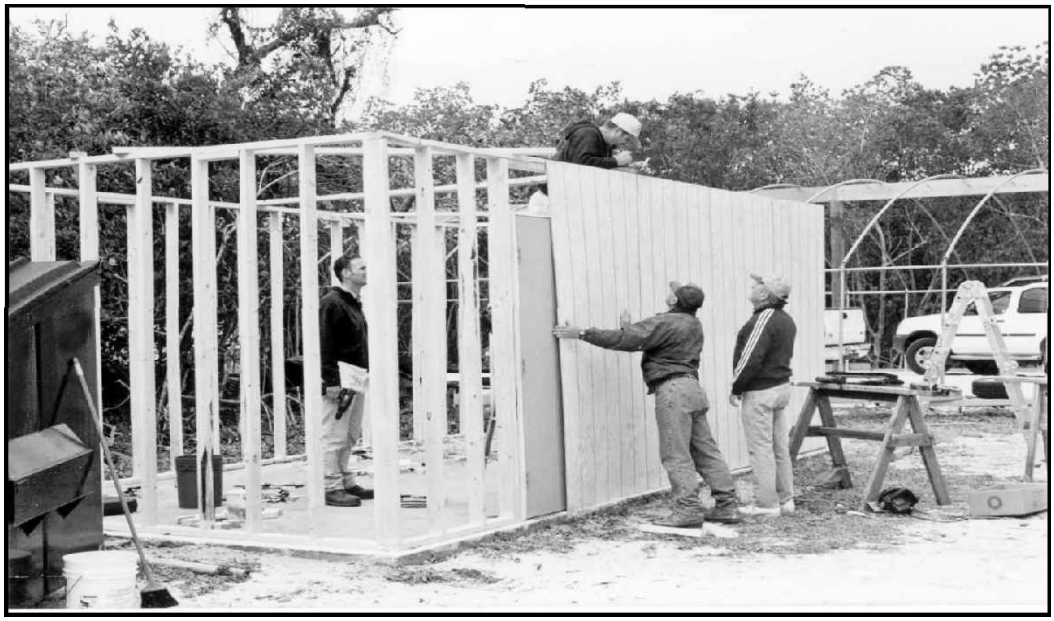

Fig. 5. REDFish's beginnings, March 2002. Lab/feed building being constructed.

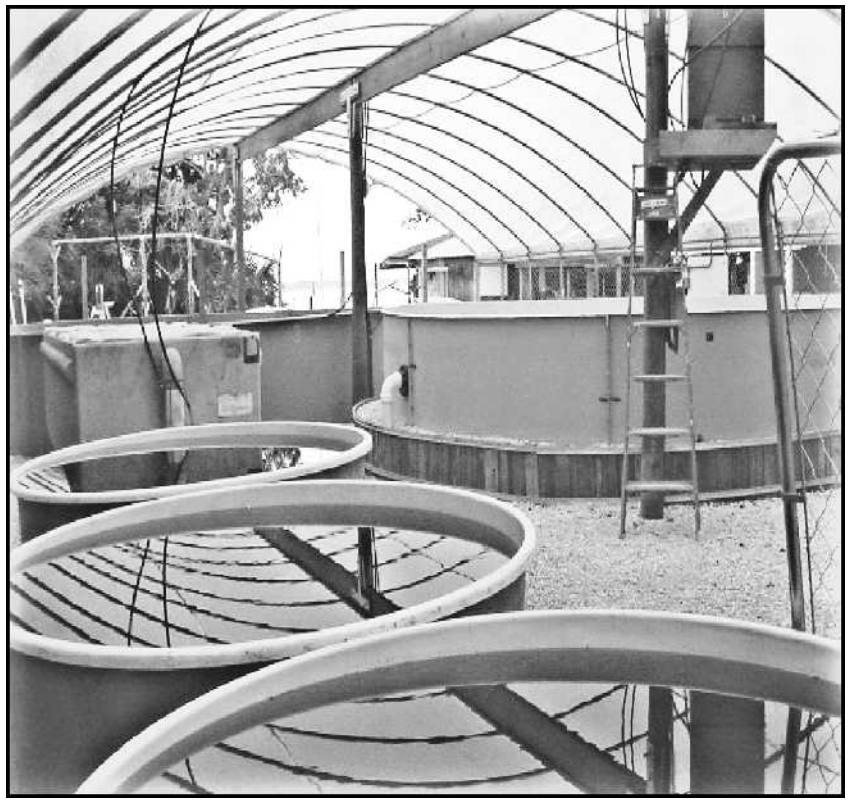

Fig. 6. Large nursery/grow-out and reservoir tanks for REDStart redfish facility, 2003–2005.

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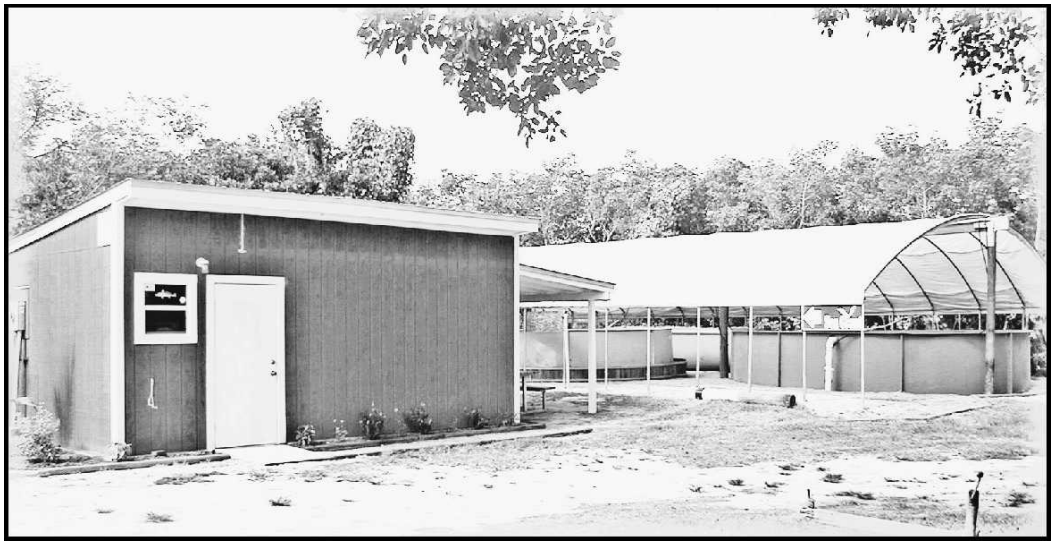

Fig. 7. New REDStart redfish grow-out facility adjacent to Marine Lab, 2002 on. Funding from FWS, SFWMD, WCIND, FL Sea Grant and private donations too numerous to name. These buildings are now used by RECON and other lab programs.

Fig. 8. Collection of juvenile redfish from large nursery/grow-out tanks for REDStart redfish facility, by lab staff and volunteers.

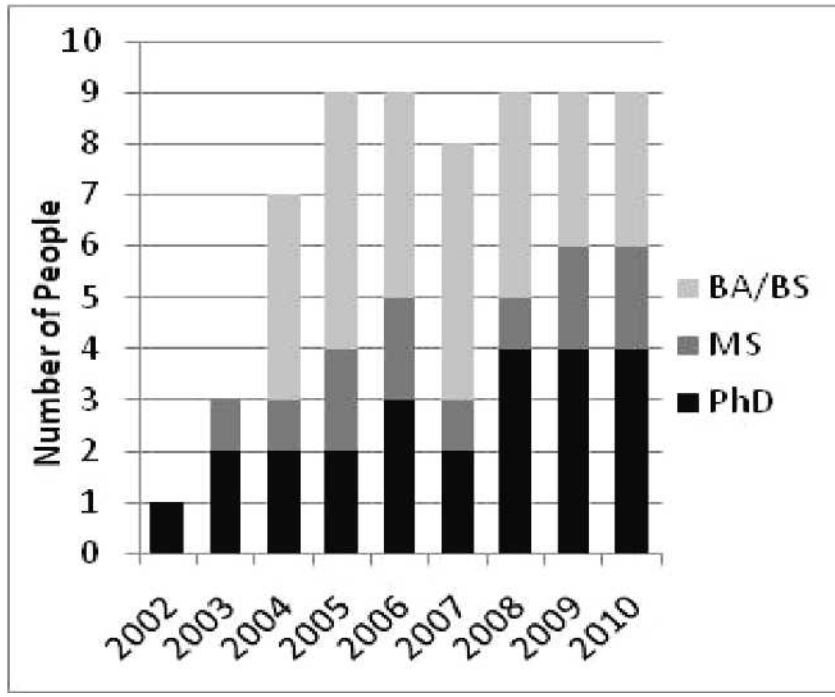

Fig. 9. Marine Lab science-related staffing from 2002–2010 (includes both Core Salary and grant-supported full time staff).

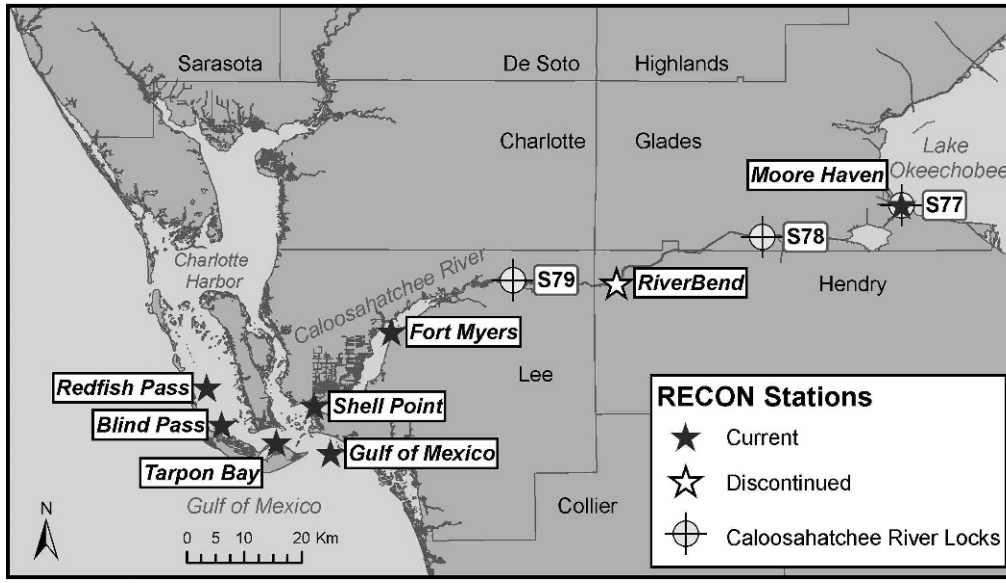

Fig. 10. SCCF Marine Lab's River, Estuary, and Coastal Observing Network (RECON) totaling 7 fixed stations and water control structures in the Caloosahatchee River and Estuary, Florida (see http://recon.sccf.org/).

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ary RECONs and our nearshore sampling efforts, we are better able to assess the regional component of any water quality degradation compared to more local inputs. Our goal is to use the RECON data to enhance our collaborations and hypothesis-driven research and restoration efforts using this unique system (presented in Oregon at CERF 2009).

GIS and Database Management

In 2008, we brought on board Dr. Alex Rybak, who was formerly with FWRI's Center for Spatial Analysis, where he managed the FL Aquatic GAP project. His research focuses on landscape-ecological analyses and spatiotemporal models of terrestrial and coastal ecosystem dynamics. His previous work includes studies on the application of multiple environmental gradients to classify landscape structure and land-cover/land-use changes within the southern coast of Crimea, GIS, remote sensing, and field-monitoring techniques to study local thermal characteristics and their effect on grassland bird distributions in the U.S. southwest. At FWC-FWRI, he managed several large-scale GIS/GPS projects, such as the National Hydrography Dataset (statewide freshwater stream habitat classification), and the development of a statewide 5-m digital elevation model for the USGS. Currently, Dr. Rybak provides a geospatial perspective for the lab and its collaborators by identifying, developing, and producing GIS-related applications for studying coastal and marine processes at the species, community, and ecosystem levels. He is also developing databases to organize, analyze, and interpret data from RECON, while also working with the Gulf of Mexico Coastal Ocean Observing System (GCOOS—the lab is a signatory member) to integrate RECON into GCOOS's data portal, an effort that involves numerous institutions and universities engaged in land–ocean monitoring activities in the Gulf Coast region. With the results of this work, SCCF can now actively engage water managers and politicians with rigorous scientific data.

Where Do We Go From Here?

At present, the lab consists of seven full-time scientific staff (Dr. Coen departed in March 2011). Five are core salary lines from the Foundation, and two are grant supported. SCCF is at a crossroads. Expertise from other marine laboratories and a strategic plan are needed to guide the Marine Lab over the next 5–10 yrs In 2010, the Marine Lab received a National Science Foundation (FSML) planning grant to develop a comprehensive plan to guide the Foundation and Marine Lab over the next 3–5 yr. The focus potentially will be an expansion of research and training, and the development of an overall strategic plan to select a site, raise funds, and construct a new Marine Lab that will accommodate a growing research staff and enhance collaborations with visiting students and researchers (in part by including more housing—currently, the lab has no housing or dedicated office space for visiting scientists).

Despite the fact that Sanibel and Captiva have such rich ecological diversity, currently there is no space devoted to displays of marine life and related science, so an Educational Center will be at least a part of the planning effort. Given the recent shift toward ''green'' construction (not yet seen on the islands), the Foundation intends to involve outside experts and study examples of other marine laboratories to incorporate and maximize green technologies and sustainable practices into the new facilities. Planning charrettes involving broad participation of the scientific community outside SCCF to develop fully the diverse elements related to research, education, and outreach that support the lab's mission while stimulating collaborations among scientists across disciplines.

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SANIBEL-CAPTIVA CONSERVATION FOUNDATION MARINE LABORATORY, 900A TARPON BAY ROAD, SANIBEL, FLORIDA 33957. Send reprint requests to ECM. CURRENT ADDRESS (LC): COASTAL WATERSHED INSTITUTE, FLORIDA GULF COAST UNIVERSITY, SOUTH WHITAKER HALL, 10501 FGCU BOULEVARD, FT. MYERS, FLORIDA 33965.

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